

We claim:

1. In a sending station operable in a radio communication system to send data upon a communication channel susceptible to distortion, the sending station having an antenna transducer set formed of at least one antenna transducer at which the data to be sent is transduced into electromagnetic form, an improvement of apparatus for placing the data in a form to facilitate communication thereof upon the communication channel, said apparatus comprising:

5 a modulator coupled to receive a group of encoder output symbols, the encoder output symbols encoded representations of the data to be communicated upon the communication channel, said modulator for forming a modulated sequence of modulator output symbols, the modulator output symbols of a number corresponding to a number of encoder output symbols of which the group of encoder output symbols are formed together with a number of antenna transducers of which the antenna transducer set is formed.

10 2. The apparatus of claim 1 wherein the number of the modulator output symbols forming the modulated sequence of modulator output symbols corresponds to a product of the number of the encoder output symbols and the number of antenna transducers.

3. The apparatus of claim 2 wherein the modulated sequence of the modulator output symbols comprises a serially-generated sequence.

4. The apparatus of claim 3 further comprising a router coupled between said modulator and the set of antenna transducers, said router selectably operable to route selected ones of the modulator output symbols to the at least one antenna transducer of the set of antenna transducers.

5. The apparatus of claim 4 wherein the set of antenna transducers comprises a first antenna transducer and at least a second antenna, wherein said router forms a serial-to-parallel converter for converting the serially-

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generated sequence of which the modulated sequence formed by said  
 5 modulator is formed into a first and at least second parallel sequence for  
 application to the first and at least second antenna transducer.

6. The apparatus of claim 1 wherein said modulator comprises a  
 space-time modulator which exhibits a unitary rate of modulation such that the  
 modulated sequence formed thereat, when transduced onto the communication  
 channel by the set of antenna transducers, exhibits a bandwidth substantially  
 5 corresponding to a bandwidth required to communicate the encoded output  
 symbols when transduced by a single antenna transducer.

7. The apparatus of claim 1 wherein the modulated sequence  
 formed by said modulator forms a QPSK (Quadrature Phase Shift Keying)-  
 modulated sequence.

8. The apparatus of claim 1 wherein the encoder output symbols  
 applied to said modulator comprise channel-encoded symbols encoded in a  
 manner by which to create time redundancy into the data of which the encoder  
 output symbols are representative.

9. The apparatus of claim 1 wherein the modulated sequence of  
 modulator output symbols comprises a plurality of sequence portions, the  
 plurality of sequence portions arranged to form columns of a code matrix in  
 which successive rows defined by the code matrix concatenated together  
 5 define a codeword.

10. In the radio communication system of claim 1 in which the data  
 transmitted upon the communication channel is transmitted to a receiving  
 station, a further improvement of apparatus for the receiving station, said  
 apparatus comprising:

5 a demodulator coupled to receive indications of the data  
 once received at the receiving station, said demodulator for demodulating the  
 indications provided thereto.

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11. The apparatus of claim 10 wherein the indications of the data to which said demodulator is coupled to receive comprise channel-decoded indications.

12. The apparatus of claim 10 wherein said demodulator performs joint demodulation and decoding operations.

~~13.~~ In a method for sending data by a sending station operable in a radio communication system upon a communication channel susceptible to distortion, the sending station having an antenna set formed of at least one antenna transducer at which the data to be sent is transduced into  
 5 electromagnetic form, and improvement of a method for placing the data in a from to facilitate communication thereof upon the communication channel, said method comprising:

providing a group of encoder output symbols to a modulator, the encoder output symbols representative of the data to be  
 10 communicated upon the communication channel; and

forming, at the modulator, a modulated sequence of modulator output symbols, the modulator output symbols of a number corresponding to a number of encoder output symbols of which the group of encoder output symbols are formed together with a number of antenna  
 15 transducers of which the antenna transducer set is formed.

14. The method of claim 13 wherein the number of the modulator output symbols formed during said operation of forming corresponds to a product of the number of encoder output symbols and the number of antenna transducers.

15. The method of claim 14 wherein the modulated sequence of the modulator output symbols formed during said operation of forming comprises a serially-generated sequence.

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16. The method of claim 15 further comprising the additional operation of routing selected ones of the modulator output symbols to the at least one antenna transducer of the set of antenna transducers.

17. The method of claim 16 wherein the set of antenna transducers comprises a first antenna transducer and at least a second antenna transducer, wherein said operation of routing comprises converting the serially-generated sequence of which the modulated sequence is formed into a first and at least  
5 second parallel sequence.

18. The method of claim 13 wherein the modulated sequence formed during said operation of forming, when transduced onto the communication channel by the set of antenna transducers, exhibits a bandwidth substantially corresponding to a bandwidth required to communicate the encoded output  
5 symbols when transduced by a single antenna transducer.

19. The method of claim 13 wherein the modulated sequence formed during said operation of forming comprises a plurality of sequence portions, the plurality of sequence portions arranged to form columns of a code matrix in which successive rows defined by the code matrix concatenated together  
5 define a codeword.

20. The method of claim 19 further comprising the additional operations of:

transmitting the modulated symbols upon the communication channel to a receiving station; and

5 demodulating the modulated symbols once received at the receiving station.

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